Implementation of Dynamically Reconfigurable Wireless Networking for Emergency Vehicles

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Abstract— The current traffic control design is not suitable for handling emergency vehicle movement. This involves lot of manual help to move the emergency vehicle from one point to another point. During this transportation called golden hours will be lost and may increase the causalities. In this work the advancement of technology is employed to give solution to this time critical and emergency situation. In this work the dynamically reconfigurable network concept is adapted into traffic light management system with the objective to move the emergency vehicle from one point to another point safely. During normal condition the road side traffic lights will get synchronized control signal from the intelligent traffic system (ITS). When an emergency vehicle is entering into zone automatically the total signals of that area will come under the control of emergency vehicle with a flash message at every signal regarding the passage of emergency vehicle. Once the vehicle passes the particular zone automatically the traffic signals will come under the control of central control station.

Key words: re – configurable network, Emergency Vehicle (EV), Intelligent Traffic System (ITS)

I.INTRODUCTION

All nodes in normal network can act either as master or slave and they are fixed. These types of network contain only one master and others will act as slave thus these networks are static. But in Autonomous Network Reconfigurable system (ARS) every nodes in the network can act as both master and slave depending on the situation and thus they become dynamically reconfigurable wireless network. This type of network can be implemented in many real time applications effectively. Here to demonstrate this dynamically reconfigurable network in real time application significantly we have chosen emergency vehicle controlling traffic signal to save the golden hours and there by invaluable human lives in emergency situation.

In this work, our main aim is to control the traffic signal from the emergency vehicle through which it passes and thus saving the unnecessary time delay due to traffic. For this application we are going to implement the self reconfigurable network in traffic signal thus we can achieve an effective Intelligent Transport System (ITS).

In this network we have two masters and four slaves which will reconfigure and control the slaves dynamically and automatically in different situation. Here we are implementing this network in traffic signals of four way junction and this traffic signal will act as slaves in the network and the main control room and emergency vehicle will be acting as the masters controlling the traffic signals slaves. In normal conditions the control room will hold the entire control over the traffic signals by altering the signals according to the situation, nowadays traffic control have one control room for particular zone. In our project whenever the emergency vehicles like Ambulance, fire engines etc., enters the particular zone the control from the control room will switch automatically from control room to emergency vehicle and EV will control all the traffic signal in its way by controlling them according to its requirement to save the golden hours. And automatically a buzzer and message will flash in both the control room and traffic signal, so that people will cooperate fully and be alert. By atomizing this manual control which is not effective is overcome significantly.

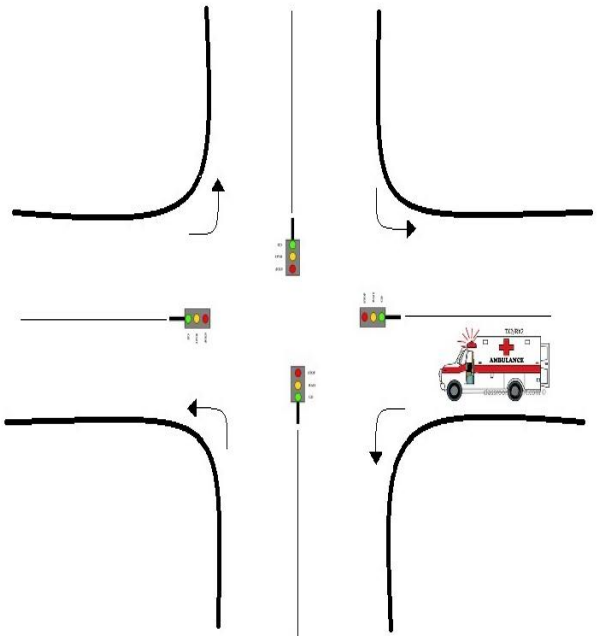

Fig.1, Traffic signal

II. MOTIVATION

In normal traffic area, whenever a Emergency Vehicle enters if the signal changes red the EV have to wait for long time because of this the golden hours are wasted. By saving this time we can save the valuable life, thus we called this time as golden hours. Hence by implementing this dynamically reconfigurable wireless network in controlling traffic signals by emergency vehicle we can reach the destination with minimum time delay automatically.

III.PROPOSED SYSTEM

The main control room and emergency vehicle will be acting as the masters controlling the traffic signals slaves. In normal conditions the control room will hold the entire control over the traffic signals by altering the signals according to the situation, nowadays traffic control have one control room for particular zone. In our project whenever the emergency vehicles like Ambulance, fire engines etc,. enters the particular zone the control from the control room will switch automatically from control room to emergency vehicle and EV will control all the traffic signal in its way by controlling them according to its requirement to save the golden hours. And automatically a buzzer and message will flash in both the control room and traffic signal, so that people will cooperate fully and be alert. By atomizing this manual control which is not effective will be overcome significantly.

Traffic status, the road conditions, etc. To achieve this, different types of data from different sources are collected in real time. Most of these sources already reside on vehicle or at road/traffic observation points. Within the scope of this work, data from these resources will be aggregated, analyzed and fused in real time to automatically sense or estimate traffic congestion in real-time.

IV. TRAFFIC CONTROL SYSTEM

ITS is Intelligent Transportation System in which Traffic light control is involved. Traffic control system is generally controlled by control room. Initially, when there is no control from control room and emergency vehicle, all the LED (Green and Red) glows simultaneously. When the control room transmits the signal to the ITS, traffic signal changes based on actual traffic density. During normal conditions, at the time of emergency vehicle entering the traffic signal zone, EV may get struck when it approaches red signal. But ITS in this paper eliminates this disadvantage. When the EV comes, the transmitter in EV starts bursting signal to the ITS. Receiver in ITS gets the signal from EV and stops getting signal from control room. Until the EV crosses the current traffic signal zone, traffic signal will be in control of EV. Once it crosses the zone completely, the control of traffic signal will go back to the control room. And the traffic signal control is resumed from last traffic time cycle.

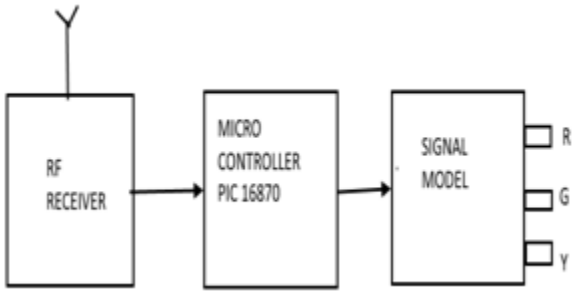

Fig.3, Block diagram for signal transmission

Fig.7, Traffic Signal Module

V.CONTROL ROOM

It is the heart of the entire Intelligent Transport System (ITS) because it will be responsible for transforming the control between EV and control room. The transmitter in the control room will be transmitting at 2.4GHz and continuously sense for EV. The major parts in control room are PIC17F870 microcontroller, buzzer, display, relay circuit, power supply, RF transmitter and receiver. The relay circuit will switch off the control room when it detects EV transmitting in same frequency and when the EV goes out of the zone it will automatically switch on the control room.

The control room will not be controlling the traffic signal continuously rather it will transmit for six seconds and sense for EV entry for five seconds thus when EV enter the zone less than six seconds it can detect the EV entry into the zone and effectively transfer the control to it. Because of this the transmit Emergency Vehicle can pass through the traffic signals with minimum delay as possible.

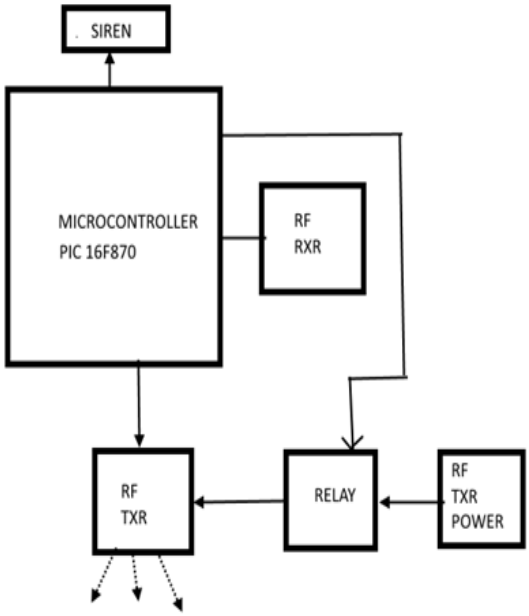

Fig.4, Block diagram for control room

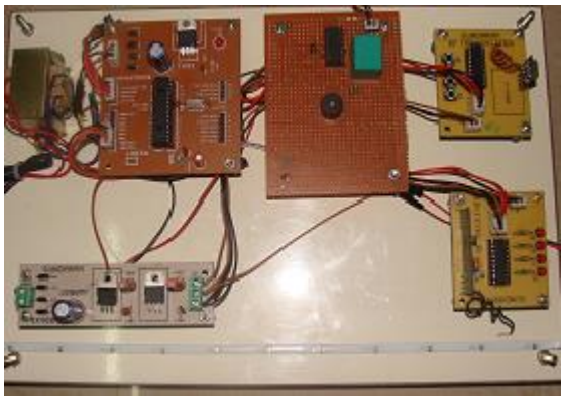

Fig.5, Control room module

VI. EMERGENCY VEHICLE

Time delay in emergency vehicle arrival is major problem because it has the ability to save many lives. Here we are designing a portable circuit to be placed in all emergency vehicles like fire engines and ambulance. In reconfigurable circuit the control over slaves is dynamic. The traffic signals will be

controlled by control room initially and whenever the EV is detected it will transfer its control to EV(Emergency Vehicle). Both the EV and control room will be transmitting in same frequency 2.4GHz ISM band. Hence to avoid conflict between EV and control room and smoothen the transportation control room will check for the EV arrival in its zone for every six seconds. After every six seconds for five seconds the control room will be off and check for EV.

The portable circuit placed in EV consists of microcontroller PIC16F870, siren, RF transmitter, RF receiver, relay circuit and power transmitter circuit. The RF transmitter will be continuously transmitting in 2.4GHz whenever it sense the traffic signals free from control in that five second it will immediately take over the control and switch off the control room through relay. The Emergency Vehicle will control the traffic signals accordingly by comparing the destination address stored in the database of ambulance circuit about the nearby hospitals and in case if the EV is from hospital or in case of fire engines the indicator of the EV is connected to the circuit to show the direction of movement, so that it can control the particular signals without disturbing the other signals and other vehicle unnecessarily.

As the EV takes the control over the traffic signals a buzzer and a message is flashed at the traffic signal zone and at the control room. This will make the people and pedestrian to cooperate more effectively and make the controller in control room to be alert.

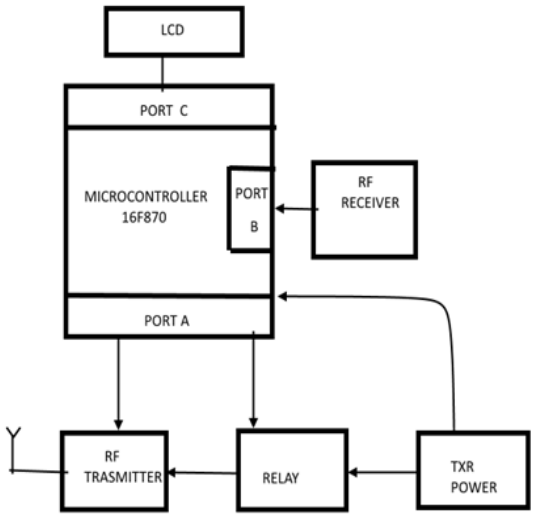

Fig.2, Block diagram for ITS

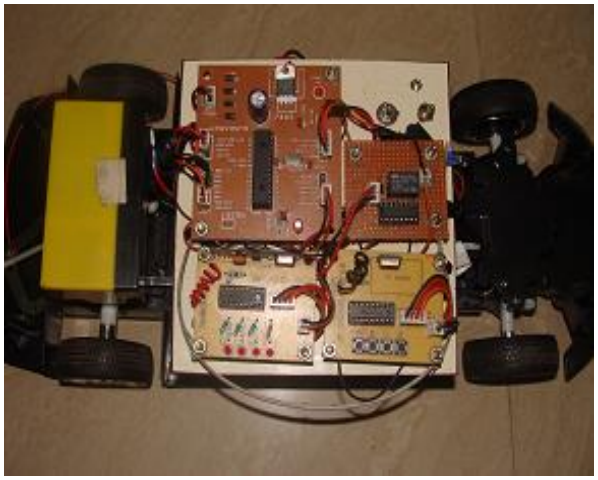

Fig.6, Emergency Vehicle module

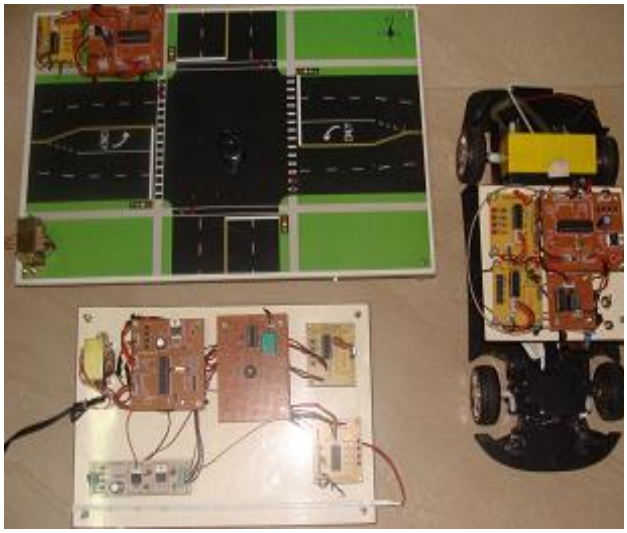

Fig.8, Overall Project Module

VII. CONCLUSION AND FUTURE WORK

In this paper, we proposed a reconfigurable wireless network for controlling the traffic signal dynamically by Emergency Vehicle. Here we have implemented ARS in traffic control system by which the emergency vehicle can control the traffic signals through which it passes by changing the traffic light accordingly. Thus it can be effectively implemented in real time application. Reconfigurable network can be significantly implemented in many real time applications. This reconfigurable network for emergency vehicles can be done more effectively by allowing EV to control the traffic signals without disturbing the other vehicles.

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